REMARKS

In view of the above amendments and arguments submitted herewith, Applicants respectfully submit that the pending application is in condition for allowance.

I. Status of the Claims

Claims 1 and 18-20 are currently pending. Claims 12-17 have been canceled. Claim 1 has been amended to include part of the subject matter of cancelled claim 17. Claims 18-20 have been amended to correct their dependency. Support for this amendment can be found, for example, in the original listing of claims. No new matter has been added by any claim amendment.

II. Rejection under 35 U.S.C. § 112

Claim 17 has been rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. In particular, the Examiner contends that by use of the "and" and "or" conjunctions in the same claim, it is not clear what claim elements are required for the invention. (Office Action, page 2, line 14 through page 3, line 4).

Claim 17 has been canceled rendering this rejection moot. Accordingly, reconsideration and withdrawal of the rejection of claim 17 are respectfully requested. Claim 1 has been amended to include part of the subject matter of claim 17. In particular, claim 1 has been amended to recite that "the impurity removing means includes: a sulfur oxide adsorbing portion having at least one of an adsorbing agent and an absorbing agent of the sulfur oxide, and a catalytic combustor disposed upstream of the sulfur oxide adsorbing portion."

III. Rejection Under 35 U.S.C. § 102

Claims 1 and 16 have been rejected under 35 U.S. C. § 102 as being anticipated by U. S. Patent No. 6,551,732 ("Xu"). The rejection as to claim 1 is moot because amended claim 1 now includes the subject matter of claim 17, which has not been rejected on this ground. Claim 16 has been canceled rendering the rejection as to claim 16 moot. Accordingly, reconsideration and

withdrawal of the rejection of claims 1 and 16 are respectfully requested.

IV. Rejection Under 35 U.S.C. § 103

Claims 12-20 have been rejected under 35 U.S. C. § 103 as being unpatentable over Xu as applied to claims 1 and 16, in view of Japanese Patent Publication No. 2003-317783 ("Shuji") and further in view of U.S. Patent Application Publication No. 2004/0035055 ("Zhu"). Claims 12-17 have been canceled rendering the rejection as to claims 12-17 moot. Claim 1 has been amended to include part of the subject matter of claim 17. Accordingly, Applicants provide the following remarks in response to the present rejection as if applied to amended claim 1. Applicants respectfully traverse this rejection.

According to the Examiner, Xu teaches a fuel cell system comprising a hydrogen generator, a fuel cell, an air supply portion, and an impurity removing means. The Examiner further contends that Shuji discloses an impurity removing means coupled to the cathode exhaust line that is routed to the reforming system of the fuel cell and wherein the system includes a burner upstream from the absorbing material. (Office Action, page 5, lines 1-22).

Claim 1 has been amended to recite, *inter alia*, as follows:

> A fuel cell system comprising:
> ...
> an impurity removing means configured to remove an impurity gas from the air, wherein the impurity removing means includes:
> a sulfur oxide adsorbing portion having at least one of an adsorbing agent and an absorbing agent of the sulfur oxide, and
> **a catalytic combustor disposed upstream of the sulfur oxide adsorbing portion**. (Emphasis added).

Contrary to the Examiner's contention, Shuji does not disclose a burner upstream from the absorbing materials. As shown in Fig. 1 of Shuji, the burner 70 is positioned downstream of an impurity remover 80 (*i.e.*, an adsorbing agent) as indicated by the direction of the arrow leading from the impurity remover 80 to the burner 70. (*See also* Attachment A - machine translation of Shuji). This is a critical distinction over the prior art as the catalytic combustor 12 of the present invention serves to facilitate the operation of the sulfur oxide absorbing portion 13.

(*See e.g.*, page 15, paragraph [0055] of the specification "Then, the air flows through the catalytic combustor 12 kept at 250° C during a normal operation, and thereafter flows through the sulfur oxide absorbing portion 13 kept at 300° C."). Accordingly, Shuji fails to disclose or suggest "a catalytic combustor disposed upstream of the sulfur oxide adsorbing portion," as recited in claim 1. Furthermore, Xu and Zhu do not overcome the above-noted deficiency of Shuji. Therefore, for the foregoing reasons, Applicants respectfully submit that neither Xu, Zhu nor Shuji, alone or in combination, discloses or suggests each and every element of amended claim 1. As such, reconsideration and withdrawal of the rejection of claim 1 are respectfully requested.

Claims 18-20 depend from claim 1. As such, Applicants respectfully submit that claims 18-20 should be allowed based at least upon their dependency from independent claim 1. Accordingly, reconsideration and withdrawal of the rejection of claims 18-20 are respectfully requested.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application, including claims 1 and 18-20, is in condition for allowance and such action is respectfully requested.

Respectfully submitted,
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(Date)

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WWS/YJK
Attachment A: Machine translation of Japanese Patent Publication No. 2003-317783 ("Shuji")

ATTACHMENT A

PATENT ABSTRACTS OF JAPAN

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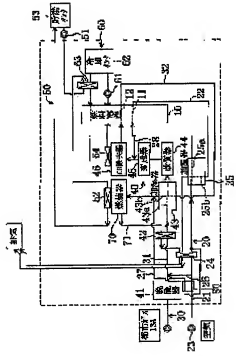
(54) FUEL CELL POWER GENERATING SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To suppress deterioration of a catalyst and prevent deterioration of workability and the cost increase due to maintenance by preventing adhesion of impurity components contained in oxygen containing gas supplied to a fuel cell power generating system to a fuel cell 10 and the catalyst of a reactor such as a reformer.

SOLUTION: An impurity remover 80 capable of adsorbing and desorbing impurities is provided in a supply passage for the oxygen containing gas. Air removed of the impurities by adsorption of the remover 80 is supplied to the fuel cell power generating system. The impurities desorbed from the remover 80 are disposed by combustion.



DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]Especially this invention relates to the fuel cell generation system provided with the fuel cell formed in this system, and the mechanism which prevents the catalyst de-activation in reactors, such as a reformer, a transformer, and a carbon monoxide removal machine, about a fuel cell generation system.

[0002]

[Description of the Prior Art]Generally, the fuel cell generation system is constituted so that the chemical energy produced by oxidation of fuel may be transformed into electrical energy. the hydrogen generated by this fuel cell generation system specifically reforming material gas, such as town gas, -- rich fuel gas and air (oxygen containing gas) are supplied to a fuel cell, and energy in case water is made by the reaction of hydrogen in fuel gas and oxygen in the air is transformed into the electrical and electric equipment. The fuel cell is constituted so that the above-mentioned reaction may be promoted using a catalyst.

[0003]He is trying to generate the fuel gas which makes hydrogen a subject generally in this fuel cell generation system by making reactors, such as a desulfurizer, a reformer, a transformer, and a carbon monoxide removal machine, pass material gas in order in the refining process of material gas.

[0004]among these -- performing processing which removes a sulfur compound from material gas in a desulfurizer -- a reformer -- hydrogen from the material gas after desulfurization -- processing which generates rich fuel gas is performed. In this reformer, although generated by carbon monoxide in connection with the reforming reaction of material gas, if a fuel cell is supplied while fuel gas had contained carbon monoxide, the catalyst used for the cell electrode of the fuel cell will carry out poisoning, and sufficient power generation characteristic will no longer be acquired. So, in the above-mentioned transformer, processing which carries out conversion of the carbon monoxide to carbon dioxide is performed.

[0005]The above-mentioned carbon monoxide removal machine is used in order to reduce further the carbon monoxide concentration in the fuel gas which passed the transformer. This is for compensating with it being required even for a level of 10 ppm or less to reduce the carbon monoxide concentration in fuel gas,

and generally being insufficient, in order to fully improve the power generation characteristic of a fuel cell generation system of just the above-mentioned transformer. Processing which removes the remaining carbon monoxide is performed by specifically mixing air to the fuel gas reformed with the reformer and the transformer, and making the carbon monoxide removal machine included the carbon monoxide selective oxidation catalyst pass this.

[0006]

[Problem(s) to be Solved by the Invention]By the way, if paint etc. are performed in the neighborhood when the above-mentioned fuel cell generation system is installed in a factory etc., organic matters, such as formaldehyde (HCHO) and acetaldehyde (CH_3 CHO), may be contained in the air supplied to a fuel cell, for example. It is mixed with fuel gas and air is supplied also to each of above-mentioned reactors while it is supplied to a fuel cell. Therefore, if an impurity like the above-mentioned organic matter is contained in air, this impurity will adhere to the catalyst of a fuel cell or each reactor, and it will become the cause that catalyst performance falls.

[0007]On the other hand, in the above-mentioned fuel cell generation system, it is also possible to supply, after letting air pass to an air filter or an adsorption filter (see JP,07-094200,A). However, fundamentally, an air filter is unsuitable for only collecting dust and removing organic matters, such as HCHO and CH_3 CHO, and functionally insufficient for it. Therefore, it is difficult to fully prevent degradation of a catalyst in this case. When using the filter which has the function to adsorb the above-mentioned organic matter, it will be necessary to exchange periodically the filter of what has possible preventing degradation of a catalyst. For this reason, complicated replacement work is required for a fixed target, a running cost becomes high, and if a replacement stage is overdue, a catalyst may deteriorate too.

[0008]it is originated in view of such a problem, and this invention comes out. The purpose is enabling it to also prevent the fall and cost hike of workability by maintenance while it prevents the impurity component contained in oxygen containing gas from adhering to a fuel cell and the catalyst of each reactor and suppresses degradation of the catalyst by the adhesion.

[0009]

[Means for Solving the Problem]This invention forms an impurity removal machine (80) in which adsorption and desorption of an impurity are possible all over a feed route (21) of air (oxygen containing gas), While supplying to a system air (oxygen containing gas) which carried out adsorption treatment of the impurity with this removal machine (80), it burns and an impurity desorbed from this removal machine (80) is processed.

[0010]The invention according to claim 1 is premised concrete on a fuel cell generation system provided with a fuel cell (10) which generates electricity by the reaction of hydrogen in fuel gas, and oxygen in oxygen containing gas, and a reactor (40) which reforms material gas and generates fuel gas. This fuel cell generation system is arranged in a feed route (21) of oxygen containing gas, and an impurity component in this gas And an impurity removal machine (80) in which adsorption and desorption are possible, While it has a burner (70) which carries out combustion treatment of this impurity component and adsorption treatment of

the impurity component in the above-mentioned oxygen containing gas is carried out in an impurity removal machine (80), it is characterized by being constituted so that an impurity component desorbed from this removal machine (80) may be burned with a burner (70).

[0011]In this invention according to claim 1, oxygen containing gas passes an impurity removal machine (80), when flowing through that feed route (21). An impurity removal machine (80) adsorbs an impurity of HCHO contained in oxygen containing gas, CH_3CHO, etc. Therefore, since oxygen containing gas with which an impurity was removed is supplied to a system, the above-mentioned impurity does not adhere to a fuel cell and a catalyst of each reactor within this system.

[0012]On the other hand, an impurity to which an impurity removal machine (80) stuck can also be desorbed from this impurity removal machine (80). And an impurity desorbed from an impurity removal machine (80) can be discharged after burning in a burner (70).

[0013]In the fuel cell generation system according to claim 1 the invention according to claim 2, An impurity removal machine (80) is provided with an adsorbing rotor (81) constituted pivotable while having been arranged ranging over the adsorption side passage (84) and the desorption side passage (85), This adsorbing rotor (81) is characterized by being constituted so that adsorption operation which adsorbs an impurity component in oxygen containing gas at the adsorption side passage (84), and desorption operation desorbed from the impurity component at the desorption side passage (85) may be performed.

[0014]In this invention according to claim 2, it is an adsorption side of an adsorbing rotor (81), and removing an impurity from oxygen containing gas, by the desorption side, an impurity to which it stuck can be made to be able to desorb and an adsorbing rotor (81) can be reproduced. Therefore, if it operates rotating an adsorbing rotor (81), a portion which adsorbed an impurity will be reproduced and it will become possible to use for adsorption again.

[0015]The invention according to claim 3 is one mode of rotation of an adsorbing rotor (81) what was specified, and specifically, In the fuel cell generation system according to claim 2, an adsorbing rotor (81) is characterized by being constituted so that adsorption operation at the adsorption side passage (84) and desorption operation at the desorption side passage (85) may be performed, rotating continuously.

[0016]The invention according to claim 4 is other modes of rotation of an adsorbing rotor (81) what was specified, and specifically, In the fuel cell generation system according to claim 2, while an adsorbing rotor (81) rotates intermittently, it is characterized by being constituted so that adsorption operation at the adsorption side passage (84) and desorption operation at the desorption side passage (85) may be performed during rotation stops.

[0017]In the fuel cell generation system according to claim 2, 3, or 4 the invention according to claim 5, To the downstream of an adsorbing rotor (81) in a feed route (21) of oxygen containing gas. A heating heat exchanger (24) to which this oxygen containing gas and exhaust gas discharged from a fuel cell perform heat exchange is provided, The downstream of a heating heat exchanger (24) in a feed route (21) of oxygen containing gas is characterized by being connected to the upstream of an adsorbing rotor (81) in the desorption side passage (85). The above-mentioned heating heat exchanger (24) may carry out heat

exchange of oxygen containing gas and the combustion gas. That is, hotter exhaust gas after combustion may be passed to a heating heat exchanger (24).

[0018]In this invention according to claim 5, a part of oxygen containing gas heated by carrying out heat exchange to exhaust gas of a fuel cell can be supplied to the desorption side passage (85) of an adsorbing rotor (81). Although an impurity to which it stuck when hot gas for reproduction passed ****s in an adsorbing rotor (81), if oxygen containing gas heated beforehand is supplied, heating quantity in that case can be stopped.

[0019]In the fuel cell generation system according to claim 2, 3, or 4 the invention according to claim 6, While the adsorption side passage (84) of an adsorbing rotor (81) is connected to an oxygen supplying tube (21) which supplies oxygen containing gas to a fuel cell (10), The desorption side passage (85) is connected to an oxygen pole exhaust pipe (22) of a fuel cell (10), and an adsorbing rotor (81) is characterized by constituting a humidity exchanger which makes oxygen containing gas collect moisture from oxygen pole exhaust gas of a fuel cell (10).

[0020]In this invention according to claim 6, oxygen containing gas absorbs moisture from an adsorbing rotor (81) while an impurity is removed by adsorbing rotor (81), and it is supplied to a fuel cell (10). Oxygen pole exhaust gas of a fuel cell (10) burns with a burner (70), after collecting impurities from an adsorbing rotor (81) while moisture is taken by an adsorbing rotor (81).

[0021]The invention according to claim 7 is characterized by being constituted by an off-gas burner for a burner (70) which burns an impurity component to burn exhaust gas discharged from a fuel cell in a fuel cell generation system given in any 1 of claims 1-6.

[0022]In this invention according to claim 7, an impurity component desorbed from an impurity removal machine (80) is supplied to an off-gas burner, and it burns with exhaust gas of a fuel cell, and can discharge after that.

[0023]

[Embodiment of the invention 1] Hereafter, Embodiment 1 of this invention is described in detail based on a drawing.

[0024]Drawing 1 is a circuit system figure of this fuel cell generation system. This fuel cell generation system is provided with the following.

Fuel cell (10).

An oxygen-system circuit (20) through which air (oxygen containing gas) flows.

A hydrogen system circuit (30) through which fuel gas flows.

reforming town gas as material gas in a hydrogen system circuit (30) -- hydrogen -- a reformer (40) constituted by two or more reactors is provided so that rich fuel gas may be generated. And fuel gas and oxygen containing gas are supplied to a fuel cell (10), hydrogen in fuel gas and oxygen in oxygen containing gas (oxidant gas) react in this fuel cell (10), and power generation is performed.

[0025]This fuel cell generation system is provided with the water cycle way (50) which generates warm water, and constitutes what is called a cogeneration system.

[0026]The above-mentioned fuel cell (10) is constituted by the solid polymer electrolyte type. The cell is constituted from this fuel cell (10) by making both sides of the electrolyte membrane which consists of a high polymer film of a fluorine system distribute a catalyst particle, and forming an electrode in them. As for the electrode on the surface of an electrolyte membrane, one side serves as a hydrogen pole (anode), and another side serves as an oxygen pole (cathode). The above-mentioned fuel cell (10) constitutes the stack (battery) by which the cell was laminated via the bipolar board. A graphic display is omitted about the structure of the fuel cell (10) mentioned above.
[0027]In the above-mentioned fuel cell (10), the oxygen pole side gas passageway (11) is formed of a bipolar board and the oxygen pole of an electrolyte membrane, and the hydrogen pole side gas passageway (12) is formed of the bipolar board and the hydrogen pole of the electrolyte membrane. An air feed pipe (21) is connected to the entrance side at the oxygen pole side gas passageway (11), and the oxygen pole exhaust pipe (22) is connected to the outlet side. On the other hand, piping connection of a reformer (40) and the hydrogen supply pipe (31) is carried out to the entrance side at the hydrogen pole side gas passageway (12), and the hydrogen pole exhaust pipe (32) is connected to the outlet side.
[0028]The cooling water circuit (60) is connected to the fuel cell (10). This cooling water circuit (60) is a closed circuit where it filled up with cooling water, and the hydrothermal exchanger (63) and the 1st heating heat exchanger (64) are connected with the cooling water pump (61) and the coolant tank (62). A cooling water circuit (60) carries out the operation which maintains a fuel cell (10) at predetermined operating temperature, when cooling water circulates.
[0029]The start edge carries out the opening of the above-mentioned air feed pipe (21) to the outdoors, and the termination is connected to the oxygen pole side gas passageway (11) of a fuel cell (10). The impurity removal machine (80) later mentioned with Blois (23) in order toward a termination from the start edge, the 1st gas heaters (24) that are heat exchangers, and the 1st humidifier (25) are formed in the air feed pipe (21).
[0030]The 1st branch pipe (26) is formed in the air feed pipe (21). As for this 1st branch pipe (26), that start edge is connected between an impurity removal machine (80) and the 1st gas heaters (24). The 2nd branch pipe (27) and the 3rd branch pipe (28) are formed in the air feed pipe (21). As for the 2nd branch pipe (27), the start edge is connected between the 1st gas heaters (24) and the 1st humidifier (25). As for the 3rd branch pipe (28), the start edge is connected with the 1st humidifier (25) between fuel cells (10).
[0031]The 1st humidifier (25) of the above is provided with the water-vapor-permeation film (not shown). A water-vapor-permeation film is a film which can penetrate a steam, for example, is constituted by the film of the hydrophilic nature of a polyvinyl alcohol film etc. passing a water-vapor-permeation film at the 1st humidifier (25) of the above -- the -- section forming of 1 humidifying side passage (25a) and the 1st exhaust gas path (25b) is carried out. the -- the air feed pipe (21) is connected to 1 humidifying side passage (25a), and the air as oxygen containing gas is introduced into it. The oxygen pole exhaust pipe (22) is connected to the 1st exhaust gas path (25b), and the oxygen pole exhaust gas discharged as cell exhaust gas from the oxygen pole side gas passageway (11) of the fuel cell (10) is introduced into it. This oxygen pole exhaust

pipe (22) passes along the 1st gas heaters (24), and is carrying out the opening to outdoor.
[0032]The above-mentioned reformer (40) is constituted so that a hydrogen subject's fuel gas may be generated from the town gas as material gas. In accordance with the flow of gas, a reformer (44), and a transformer (45) and CO (carbon monoxide) removal machine (46) are formed in this reformer (40) in order. [a desulfurizer (41), the 2nd gas heaters (42) that are heat exchangers, and] [the 2nd humidifier (43) and] Between the desulfurizer (41) in a reformer (40), and the 2nd gas heaters (42), the 1st branch pipe (26) of the air feed pipe (21) is connected.
[0033]The above-mentioned desulfurizer (41) comprises town gas supplied as material gas so that adsorption treatment of the sulfur content may be carried out.
[0034]The 2nd humidifier (43) of the above is provided with the water-vapor-permeation film (not shown). A water-vapor-permeation film is a film which can penetrate a steam, for example, is constituted by the film of the hydrophilic nature of a polyvinyl alcohol film etc. passing a water-vapor-permeation film at the 2nd humidifier (43) of the above -- the -- section forming of 2 humidifying side passage (43a) and the 2nd exhaust gas path (43b) is carried out. the -- 2 humidifying side passage (43a) is provided between the 2nd gas heaters (42) in a reformer (40), and a reformer (44), and material gas is introduced. The hydrogen pole exhaust pipe (32) is connected to the 2nd exhaust gas path (43b), and the hydrogen pole exhaust gas discharged as cell exhaust gas from the hydrogen pole side gas passageway (12) of the fuel cell (10) is introduced into it.
[0035]The above-mentioned reformer (44) is provided with the following.
The catalyst which presents activity to partial oxidation reaction.
The catalyst which presents activity to a steam reforming reaction.
In a reformer (44), hydrogen is generated by partial oxidation reaction and the steam reforming reaction from material gas. In that case, the reaction fever of the partial oxidation reaction which is an exoergic reaction is used for a reformer (44) as reaction fever of the steam reforming reaction which is an endoergic reaction.
[0036]The above-mentioned transformer (45) is provided with the catalyst which presents activity to a water gas shift reaction (carbon monoxide shift reaction). In a transformer (45), hydrogen increases by it at the same time the carbon monoxide in gas is reduced by the water gas shift reaction.
[0037]The above-mentioned CO removal machine (46) is provided with the catalyst which presents activity to CO selective oxidation reaction. In CO removal machine (46), COs in gas are further reduced by CO selective oxidation reaction. And the hydrogen supply pipe (31) is connected to the fuel cell (10) so that the gas of the hydrogen subject who came out of CO removal machine (46) may be supplied to the hydrogen pole side gas passageway (12) of a fuel cell (10) as fuel gas.
[0038]The burner (off-gas burner) (70) is formed in the above-mentioned hydrogen pole exhaust pipe (32), and the 2nd branch pipe (27) of the above-mentioned air feed pipe (21) is connected between the 2nd humidifier (43) in the above-mentioned reformer (40), and a burner (70). Between the transformer (45) and CO removal machine (46) in this reformer (40), the 3rd branch pipe (28) of the above-mentioned air feed pipe (21) is connected.

[0039]It is connected to the termination of a hydrogen pole exhaust pipe (32), and the above-mentioned burner (70) is constituted so that combustible components, such as hydrogen (H_2) which remains in hydrogen pole exhaust gas, may be burned using the air supplied from the 2nd branch pipe (27). The start edge of the combustion gas pipe (71) is connected to the burner (70). The termination carries out the opening of the combustion gas pipe (71) to the outdoors, and the 2nd gas heaters (42) and the 1st gas heaters (24) are formed in the middle. The hot combustion gas generated by combustion of hydrogen pole exhaust gas flows through this combustion gas pipe (71), and is discharged on the outdoors.
[0040]The above-mentioned water cycle way (50) is a closed circuit where it filled up with heat medium water. In the circulating direction of heat medium water, the circulating pump (51), a hydrothermal exchanger (63) and the 2nd heating heat exchanger (52), and the hot water reservoir tank (53) are established in this water cycle way (50) in order. The heat medium water which circulates through a water cycle way (50) is heated by the hydrothermal exchanger (63) and the 2nd heating heat exchanger (52), turns into warm water, and is stored in a hot water reservoir tank (53). And hot water supply is presented with the warm water of a hot water reservoir tank (53) if needed.
[0041]Although not illustrated, section forming of a circulating-water-flow way and the heat-medium-water channel is carried out to the above-mentioned hydrothermal exchanger (63). As for the hydrothermal exchanger (63), the circulating-water-flow way is connected to a cooling water circuit (60), and the heat-medium-water channel is connected to the water cycle way (50). This hydrothermal exchanger (63) is constituted so that heat exchange of the cooling water of a circulating-water-flow way and the heat medium water of a heat-medium-water channel may be carried out. The above-mentioned 2nd heating heat exchanger (52) is constituted so that heat exchange of a combustion gas and the heat medium water may be carried out.
[0042]Next, the impurity removal machine (80) which is the feature of this invention is explained.
[0043]As shown in drawing 2 which is the elements on larger scale of drawing 1, the impurity component in this air is provided in the impurity removal machine (80) in which adsorption and desorption are possible by the air feed pipe (21) as a feed route of air (oxygen containing gas).
[0044]This impurity removal machine (80) is provided with the adsorbing rotor (81) as shown in drawing 3 and drawing 4. Although the adsorbing rotor (81) is not illustrated for details, it is constituted by the disc-like honeycomb substrate which has breathability in a thickness direction. This adsorbing rotor (81) contains adsorbent, such as permutite, a molecular sieve, and activated carbon, for example as an adsorbate effective for adsorption of the impurity of HCHO contained in the air, CH_3CHO, etc.
[0045]For the whole adsorbing rotor (81), the above-mentioned impurity removal machine (80) is provided with a wrap casing (82), and the inside of a casing (82) is divided by the sealing member (83) in the space which is four whose central angles are 90 degrees. And one side of two space (84, 85) which faces is constituted by the adsorption side passage (84), and another side is constituted by the desorption side passage (85). Two space which remains is the space through which gas does not flow.
[0046]The above-mentioned adsorption side passage (84) is connected to an air feed pipe (21), and the

desorption side passage (85) is connected to the 2nd branch pipe (27) of an air feed pipe (21). This 2nd branch pipe (27) is connected between the 2nd humidifier [in / in the other end / a hydrogen pole exhaust pipe (32)] (43), and a burner (70) while one end is connected between the 1st gas heaters (24) and the 1st humidifier (25) in an air feed pipe (21).

[0047]Thus, the above-mentioned adsorbing rotor (81) is arranged ranging over the adsorption side passage (84) connected to the air feed pipe (21), and the desorption side passage (85) connected to the 2nd branch pipe (27). An adsorbing rotor (81) is connected with drive mechanism (86), and is constituted by this drive mechanism (86) pivotable.

[0048]An adsorbing rotor (81) performs adsorption operation which adsorbs the impurity component in oxygen containing gas at the adsorption side passage (84), and desorption operation desorbed from the impurity component at the desorption side passage (85). For example, rotating continuously, an adsorbing rotor (81) can be constituted so that adsorption operation at the adsorption side passage (84) and desorption operation at the desorption side passage (85) may be performed. As composition rotated intermittently, an adsorbing rotor (81) can also be constituted so that adsorption operation at the adsorption side passage (84) and desorption operation at the desorption side passage (85) may be performed during the rotation stops.

[0049]Concretely, an adsorbing rotor (81) desorbs an impurity at the hot desorption side passage (85), when the impurity in the air is adsorbed and 180 degrees rotates at the low-temperature adsorption side passage (84). An adsorbing rotor radiates heat in the position rotated 90 more degrees from the desorption side passage (85), and after it lowers temperature, it returns to the adsorption side passage (84). It is made easy to suppress the fall of the adsorption performance in the adsorption side passage (84), and to adsorb the impurity in the air for by the following adsorption stroke by carrying out like this, at adsorbent.

[0050]Since the air after the above-mentioned burner (70) passes the above-mentioned impurity removal machine (80) is supplied via the 2nd branch pipe (27) on the other hand, In addition to burning the hydrogen (H_2) which remains in hydrogen pole exhaust gas, the operation which burns and processes the impurity component desorbed from this impurity removal machine (80) is also performed. That is, the burner (70) of this invention used for burning and processing the impurity component in the air is constituted from this embodiment by the off-gas burner for burning the hydrogen pole exhaust gas discharged from the hydrogen pole of a fuel cell (10).

[0051]The 1st gas heaters (24) of the above are located in the downstream of the adsorbing rotor (81) in the feed route of oxygen containing gas, and constitute the heating heat exchanger in which the exhaust gas discharged from a fuel cell (10) and the above-mentioned oxygen containing gas carry out heat exchange from this embodiment. And the downstream of the 1st gas heaters (24) is connected to the desorption side passage (85) of an adsorbing rotor (81), and he is trying for the feed route of this oxygen containing gas to supply the air preheated with the 1st gas heaters (24) to the desorption side passage (85) of an adsorbing rotor (81). The air supplied to the desorption side passage (85) of an adsorbing rotor (81) may be constituted so that it may heat separately if needed.

[0052]- Explain operation operation -, next operation operation of the above-mentioned fuel cell generation system.

[0053]First, air will be incorporated into this air feed pipe (21) if an air feed pipe (Blois (23 of 21)) is operated at the time of starting. As for this air, that part is sent to a reformer (40) through the 1st branch pipe (26), and the remainder passes through the adsorption side passage of an adsorbing rotor (81) as oxygen containing gas (oxidant gas). Thereby, oxygen containing gas flows out of an adsorbing rotor (81), where an impurity is removed, and it is introduced to the 1st gas heaters (24). While flowing through the 1st gas heaters (24), from air pole exhaust gas and combustion gas, the endothermic of this oxygen containing gas is carried out, and it is heated.

[0054]the oxygen containing gas heated in the 1st gas heaters (24) continues -- the [of the 1st humidifier (25)] -- it flows into 1 humidifying side passage (25a). Oxygen pole exhaust gas is introduced into the 1st exhaust gas path (25b) of the 1st humidifier (25) at this time. the [and] -- the steam in the oxygen pole exhaust gas which penetrated the water-vapor-permeation film of the 1st humidifier (25) is supplied to the oxygen containing gas (air) of 1 humidifying side passage (25a). That is, in this 1st humidifier (25), the steams discharged from the fuel cell (10) are collected by oxygen containing gas (air).

[0055]The oxygen containing gas humidified in the 1st humidifier (25) is introduced to the oxygen pole side gas passageway (11) of a fuel cell (10). Thus, desiccation of the electrolyte membrane in a fuel cell (10) is prevented by humidifying the oxygen containing gas introduced to the oxygen pole side gas passageway (11) with the 1st humidifier (25).

[0056]Town gas is supplied to a reformer (40) as material gas. This material gas is introduced first to a desulfurizer (41). In a desulfurizer (41), the sulfur content contained in material gas is removed. The material gas which came out of the desulfurizer (41) is introduced to the 2nd gas heaters (42), after the air from the 1st branch pipe (26) is mixed. While flowing through the 2nd gas heaters (42), from combustion gas, the endothermic of this material gas is carried out, and it is heated.

[0057]the material gas heated in the 2nd gas heaters (42) continues -- the [of the 2nd humidifier (43)] -- it flows into 2 humidifying side passage (43a). On the other hand, hydrogen pole exhaust gas is introduced into the 2nd exhaust gas path (43b) of the 2nd humidifier (43). the [and] -- the steam in the hydrogen pole exhaust gas which penetrated the water-vapor-permeation film is supplied to the material gas of 2 humidifying side passage (43a). In this 2nd humidifier (43), the steam of a complement is given to the steam reforming reaction in a reformer (44), and the water gas shift reaction in a transformer (45) to material gas.

[0058]The material gas humidified with the 2nd humidifier (43) is introduced to a reformer (44). That is, to a reformer (44), the material gas which is a mixture of town gas, air, and a steam is supplied. In a reformer (44), the partial oxidation reaction and the steam reforming reaction of methane (CH_4) are performed, and hydrogen (H_2) and carbon monoxide (CO) are generated. The reaction formula of the partial oxidation reaction in a reformer (44) and a steam reforming reaction is $CH_4+1/2O_2$-> $CO+2H_2$. -- Partial-oxidation-reaction CH_4+H_2O -> $CO+3H_2$ -- It is as being shown in a steam reforming reaction.

[0059]The gas after the reaction which flowed out of the reformer (44) is sent to a transformer (45). Hydrogen and carbon monoxide which were generated with the reformer (44) are contained in the gas introduced to a transformer (45). In this gas, the steam which was not used for the steam reforming reaction of what was supplied in the 2nd humidifier (43) remains. In a transformer (45), a water gas shift reaction is performed, and hydrogen increases at the same time carbon monoxide decreases in number. The reaction formula of a water gas shift reaction is $CO+H_2O \rightarrow CO_2+H_2$. -- It is as being shown in a water gas shift reaction.

[0060]The gas which came out of the transformer (45) is introduced to CO removal machine (46). Here, the gas sent to CO removal machine (46) from a transformer (45) still contains carbon monoxide, although hydrogen serves as the main ingredients. This carbon monoxide serves as catalyst poison of a hydrogen pole, remained. Then, CO removal machine (46) reduces the carbon monoxide in gas further by CO selective oxidation reaction. The reaction formula of CO selective oxidation reaction is as follows. $CO+1/2O_2 \rightarrow CO_2$ -- CO selective oxidation reaction and the gas which had carbon monoxide reduced with CO removal machine (46) are supplied to the hydrogen pole side gas passageway (12) of a fuel cell (10) as fuel gas.

[0061]As mentioned above, fuel gas is supplied to the hydrogen pole side gas passageway (12), and oxygen containing gas (oxidant gas) is supplied to a fuel cell (10) to the oxygen pole side gas passageway (11). A fuel cell (10) uses hydrogen in fuel gas as fuel, and generates electricity by using oxygen in oxygen containing gas as an oxidizer. Concretely, in a fuel cell (10), the following cell reaction is performed in the electrode surface of a hydrogen pole and an oxygen pole.

hydrogen pole: -- $2H_2 \rightarrow 4H^+ + 4e^-$ oxygen pole: -- $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$ -- by this cell reaction, the chemical energy of the combustion reaction of the hydrogen contained in fuel gas is changed into electrical energy.

[0062]From the oxygen pole side gas passageway (11) of a fuel cell (10), oxygen pole exhaust gas is discharged as cell exhaust gas. The surplus oxygen which was not used for a cell reaction is contained in this oxygen pole exhaust gas. In oxygen pole exhaust gas, H_2O produced by the cell reaction exists in the state of a steam. This oxygen pole exhaust gas is introduced through an oxygen pole exhaust pipe (22) to the 1st exhaust gas path (25b) of the 1st humidifier (25). as mentioned above -- the steam in oxygen pole exhaust gas penetrates a water-vapor-permeation film -- the -- the oxygen containing gas (air) of 1 humidifying side passage (25a) is supplied. The oxygen pole exhaust gas from which the steam was taken in the 1st humidifier (25) is exhausted after passing the 1st gas heaters (24).

[0063]On the other hand, from the hydrogen pole side gas passageway (12) of a fuel cell (10), hydrogen pole exhaust gas is discharged as cell exhaust gas. The hydrogen which was not used for a cell reaction remains in this hydrogen pole exhaust gas. In hydrogen pole exhaust gas, H_2O produced by the cell reaction exists in the state of a steam. This hydrogen pole exhaust gas is introduced through a hydrogen

pole exhaust pipe (32) to the 2nd exhaust gas path (43b) of the 2nd humidifier (43). as mentioned above -- the steam in hydrogen pole exhaust gas penetrates a water-vapor-permeation film -- the -- the material gas of 2 humidifying side passage (43a) is supplied. The hydrogen pole exhaust gas from which the steam was taken in the 2nd humidifier (43) is sent into a burner (70).

[0064]A burner (70) burns hydrogen in hydrogen pole exhaust gas using the pure oxygen containing gas which passed the adsorbing rotor (81). Hot combustion gas generates by combustion of this hydrogen pole exhaust gas. This combustion gas radiates heat in a burner (70) to the heat medium water which flows through the 2nd heating heat exchanger (52).

[0065]The combustion gas which flowed out of the burner (70) is introduced continuously to the 2nd gas heaters (42). In the 2nd gas heaters (42), combustion gas radiates heat to material gas. This combustion gas passes the 1st gas heaters (24) further, and radiates heat further to oxygen containing gas (air) in that case. Then, combustion gas comes out from the channel of combustion gas, and is exhausted on the outdoors.

[0066]On the other hand, in a cooling water circuit (60), cooling water circulates by operation of a cooling water pump (61). After cooling water flows into a hydrothermal exchanger (63) from a coolant tank (62) first and radiates heat to the heat medium water of a water cycle way (50), it is sent to a fuel cell (10) and, specifically, performs an endothermic action. A fuel cell (10) is maintained by predetermined operating temperature (for example, about 85 **) by the endothermic action of this cooling water. After the cooling water which carried out the endothermic with the fuel cell (10) is heated with CO removal machine (46) in the 1st heating heat exchanger (64), it is inhaled by the cooling water pump (61). Then, the cooling water breathed out from the cooling water pump (61) flows into a coolant tank (62), and the same circulation is repeated henceforth.

[0067]On a water cycle way (50), heat medium water circulates by operation of a circulating pump (51). The heat medium water which flowed out of the hot water reservoir tank (53) is sent into the stream way of a hydrothermal exchanger (63) by a circulating pump (51). In a hydrothermal exchanger (63), while flowing through a heat-medium-water channel, the endothermic of the heat medium water is carried out from the cooling water of a circulating-water-flow way. Thereby, exhaust heat of a fuel cell (10) and CO removal machine (46) is collected by heat medium water.

[0068]Then, heat medium water is introduced to the 2nd heating heat exchanger (52). In the 2nd heating heat exchanger (52), the endothermic of the heat medium water is carried out from the combustion gas of a burner (70). That is, the combustion heat of the hydrogen which remains in hydrogen pole exhaust gas is collected by heat medium water. And the heat medium water which came out of the 2nd heating heat exchanger (52) is returned to a hot water reservoir tank (53), and is stored as warm water. The heat medium water stored in the hot water reservoir tank (53) as warm water is used for hot water supply.

[0069]In the above operation operation, the adsorbing rotor (81) is adsorbing the impurity contained in this air, when the air which flows through an air feed pipe (21) passes through the adsorption side passage (84). Therefore, since a fuel cell (10) is begun and an impurity hardly flows also into each reactor, such as a

desulfurizer (41), a reformer (44), a transformer (45), and a carbon monoxide removal machine (46), it can suppress that a catalyst deteriorates by poisoning.

[0070]On the other hand, after carrying out the endothermic of the pure air which passed the adsorbing rotor (81) from air pole exhaust gas and combustion gas in the 1st gas heaters (24) and being heated, a part passes through the desorption side passage (85) of an adsorbing rotor (81). And in this adsorbing rotor (81), when hot oxygen containing gas passes through the desorption side passage (85), an adhering impurity ****s. The impurity desorbed from the adsorbing rotor (81) is discharged, after flowing into a burner (70) and burning with oxygen containing gas.

[0071]Since the portion in this desorption side passage (85) is reproduced when an impurity component ****s at the desorption side passage (85) of an adsorbing rotor (81), if an adsorbing rotor (81) is rotated, it will become possible to use the portion for adsorption operation again.

[0072]As explained above, according to this embodiment, the oxygen containing gas which carried out adsorption treatment of the impurity in the impurity removal machine (80) by supplying a fuel cell generation system. Since the fuel cell (10) formed in this system is begun and the above-mentioned impurity is kept from adhering to a catalyst in each reactor, such as a desulfurizer (41), a reformer (44), a transformer (45), and a carbon monoxide removal machine (46), each reaction catalyst can be prevented from deteriorating with catalyst poison. Since it can discharge after burning and processing the organic matter ingredient collected with the impurity removal machine (80), the circumference can be maintained at a clean state.

[0073]Since the adsorbing rotor (81) is used for the impurity removal machine (80), adsorption and desorption of an impurity can be performed simultaneously. For this reason, since it becomes possible to reproduce next the portion which adsorbed the impurity and to use for adsorption again, rotating an adsorbing rotor (81), continuous running becomes possible. This is the same, when it constitutes so that continuous rotation of the adsorbing rotor (81) may be carried out, or when it constitutes so that intermittent rotation may be carried out.

[0074]Since he is trying to supply the part to the desorption side passage (85) of an adsorbing rotor (81) after heating the pure air which passed the adsorbing rotor (81) by heat exchange with the exhaust gas of a fuel cell (10), the heating quantity at the time of reproduction of an adsorbing rotor (81) can be stopped. Thereby, the running cost of a device can be prevented from becoming high.

[0075]According to this embodiment, the off-gas burner which burns hydrogen pole exhaust gas is used as a burner (70) which burns an impurity component. Therefore, the burner (70) for exclusive use for burning an impurity becomes unnecessary, and can prevent complication and cost hike of an equipment configuration.

[0076]- Although the 2nd humidifier (43) is formed in the feed route of fuel gas and he is trying to humidify fuel gas in the example of modification-drawing 1 of Embodiment 1, a fuel cell generation system may be made the composition which does not form this 2nd humidifier (43).

[0077]As shown in drawing 5, in this example, the steam feeder (47) is connected to the reformer (40) between the 2nd gas heaters (42) and a reformer (44) instead of forming the 2nd humidifier (43). A humidity exchanger (48) is connected to the hydrogen pole exhaust pipe (32) of a fuel cell (10), and he is trying to

collect the moisture of hydrogen pole exhaust gas.
[0078]Also in this modification, the impurity removal machine (80) is formed in the air feed pipe (21). As an impurity removal machine (80) is shown in drawing 6, the inside of a casing (82) is divided into two by the sealing member (83), one side becomes the adsorption side passage (84), and another side has become the desorption side passage (85). Thereby, an adsorbing rotor (81) adsorbs the impurity in oxygen containing gas in the whole about 1-/field two, and performs reproduction motion in the remaining about 1-/fields two. By performing adsorption operation and reproduction motion simultaneously, carrying out continuous rotation of the adsorbing rotor (81) also in this case, or performing adsorption operation and reproduction motion simultaneously during rotation stops, carrying out intermittent rotation of the adsorbing rotor (81), A fuel cell generation system can be run continuously using the air which removed the impurity.
[0079]Also in this modification, since the impurity removal machine (80) is formed in the air feed pipe (21) which is an air supply course, While being able to prevent the catalyst of a fuel cell (10) and a reactor (44-46) from deteriorating, since the impurity contained in the gas after desorption burns, the circumference can be kept clean.
[0080]
[Embodiment of the invention 2] Embodiment 2 of this invention is the example which changed arrangement of the adsorbing rotor (81) in Embodiment 1. In this Embodiment 2, an adsorbing rotor (81) constitutes the humidity exchanger while constituting an impurity removal machine (80).
[0081]According to this Embodiment 2, the impurity removal machine (80) is arranged at the position of the 1st humidifier (25) in Embodiment 1. And while an air feed pipe (21) is connected to the adsorption side passage (84), the oxygen pole exhaust pipe (22) is connected to the desorption side passage (85). According to this Embodiment 2, the 2nd branch pipe (27) of an air feed pipe (21) is not formed, but the oxygen pole exhaust pipe (22) is connected between the 2nd humidifier (43) in a hydrogen pole exhaust pipe (32), and a burner (70). Depending on the case, the 2nd branch pipe (27) of an air feed pipe (21) may be formed, and this may be made to join the downstream of the adsorbing rotor (81) in an oxygen pole exhaust pipe (22).
[0082]In this embodiment, the 1st gas heaters (24) of Embodiment 1 are not formed.
[0083]As for the whole circuitry, this Embodiment 2 is constituted like Embodiment 1 except for the above point. It is the same as that of Embodiment 1 also about the composition of the impurity removal machine (80) itself.
[0084]If constituted in this way, the air which flows through an air feed pipe (21) will flow into the adsorption side passage of an adsorbing rotor (81). Since the impurity in the air is removed in an adsorbing rotor (81), pure air is supplied to a fuel cell (10). At this time, the adsorbing rotor (81) is adsorbed in the moisture of the oxygen pole exhaust gas of a fuel cell (10), and air collects these moisture and is supplied to a fuel cell (10). That is, while the air which passes an adsorbing rotor (81) is removed by the adsorbing rotor (81) in an impurity, it collects moisture from an adsorbing rotor (81). The pure air which passed the adsorbing rotor (81) in CO removal machine (46) is supplied.

[0085]In the desorption side of an adsorbing rotor (81), an adhering impurity component ****s with the oxygen pole exhaust gas which is an elevated temperature by the reaction in the fuel cell (10). Thereby, an adsorbing rotor (81) is reproduced. The reproduced portion moves to the adsorption side passage (84) with the rotation, and an adsorbing rotor (81) is again used for adsorption operation. The oxygen pole exhaust gas which flowed out of the adsorbing rotor (81) is supplied to a burner (70) with hydrogen pole exhaust gas, and is exhausted after combustion.

[0086]Also in this composition, since he is trying to supply the air which removed the impurity to a fuel cell (10) and CO removal machine (46), degradation of the catalyst by an impurity can be suppressed. Since it constitutes so that it may burn after desorbing an impurity from an adsorbing rotor (81), soiling the surrounding environment can also be prevented.

[0087]

[The embodiment of others of an invention] This invention is good also as following composition about the above-mentioned embodiment.

[0088]For example, although the adsorbing rotor (81) is used for the impurity removal machine (80) in the above-mentioned embodiment, While an impurity removal machine (80) provides two adsorbing members, for example, as composition which can switch the passage of oxygen containing gas and fuel gas, It may constitute so that it may operate switching by turns the state of using for the another side reproduction (desorption)-side, and the state of using for the adsorption-on another side side at the one side reproduction-side to the adsorption side to one side of an adsorbing member. Thus, what is necessary is just to comprise this invention so that it is possible to change the composition of an impurity removal machine (80) suitably and desorption from the impurity to which it stuck in short while the impurity removal machine (80) adsorbed the impurity in oxygen is possible.

[0089]Although the off-gas burner which burns the hydrogen pole exhaust gas of a fuel cell (10) is used in the above-mentioned embodiment as a burner (70) which burns the impurity desorbed from the adsorbing rotor (81), by a case, a burner for exclusive use may be formed instead of this off-gas burner.

[0090]

[Effect of the Invention]According to the invention according to claim 1, the oxygen containing gas which carried out adsorption treatment of the impurity in the impurity removal machine (80) by supplying a fuel cell generation system. A fuel cell (10) is begun, and since the above-mentioned impurity is kept from adhering to the catalyst of reactors, such as the desulfurizer (41), reformer (44) and transformer (45) which are provided in this system, and a carbon monoxide removal machine (46), it can prevent each reaction catalyst deteriorating with catalyst poison. Since the organic matter ingredient collected with the impurity removal machine (80) can be discharged after combustion treatment, a clean state can be maintained.

[0091]According to the invention according to claim 2 to 4, adsorption and desorption of an impurity can be simultaneously performed by using an adsorbing rotor (81) for an impurity removal machine (80). Therefore, since it will become possible to reproduce the portion which adsorbed the impurity and to use for adsorption again if an adsorbing rotor (81) is rotated, continuous running becomes possible.

[0092]By supplying a part of oxygen containing gas heated by heat exchange with the exhaust gas of a fuel cell (10) to the desorption side passage (85) of an adsorbing rotor (81) according to the invention according to claim 5, Since the heating quantity at the time of reproduction of an adsorbing rotor (81) can be stopped, the running cost of a device can be prevented from becoming high.

[0093]According to the invention according to claim 6, since the adsorbing rotor (81) has composition which serves as a humidity exchanger, the composition of a system can be simplified.

[0094]According to the invention according to claim 7, since the off-gas burner is used as a burner (70) which burns an impurity component, the burner (70) for exclusive use for burning an impurity becomes unnecessary, and can prevent complication and cost hike of an equipment configuration.

[Translation done.]